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Modeling of the Mechanism of Ion Channel Opening of the Visual Receptor's Rod on the Light and Allosteric Effect of Rhodopsin in the Phosphorylation Process

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Abstract : In the first part of the paper it is shown that both the depolarization of the cytoplasmic membrane of rods observed in invertebrates and hyperpolarization characteristic of vertebrates on the light may activate the functioning of ion (Na+) channels of cytoplasmic membrane of rods and thus provide the emergence of nerve impulse and its transfer to the neighboring neuron etc. In the second part, using the quantum mechanical program for modeling of the molecular processes, we got a clear picture demonstrating the effect of charged phosphate groups on the protein components of α-helical subunits of the visual rhodopsin receptor. The analysis shows that the phosphorylation of terminal amino acid of seventh α-helical subunits of the visual rhodopsin causes a redistribution of electron density on the atoms, i.e. polarization of subunits, also the changing the configuration of the nuclear subsystem, which corresponds to the deformation process in the molecule. Based on the use of models it can be concluded that this system has an internal relationship between polarization and deformation processes that indicates on the allosteric effect. The allosteric effect is based on quantum-mechanical principle of the self-consistency of the molecules.

Keywords : membrane potential, ion channels, visual rhodopsin, allosteric effect
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